Evaluating the Spillover Effects of the Plan Colombia in Ecuador

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Evaluating the Spillover Effects of the Plan Colombia in Ecuador

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Abstract

The implementation of the Plan Colombia is thought to have had significant violence-related spillovers in Ecuador's bordering provinces with Colombia. We investigate whether the Plan Colombia lead to an increase in violence, measured by homicide rates, in such provinces. Using a difference in difference approach we do not find any evidence of a crime-increasing effect. As a next step, we evaluate the impact of migration on the level of homicides in Ecuador. The instrumental variable results, based on the intensity of the Plan Colombia, show a significant, although small, crime-reducing effect.

Keywords: Plan Colombia, Ecuador, Violence and Migration.
JEL Classification: D74, F22, K42, O54.

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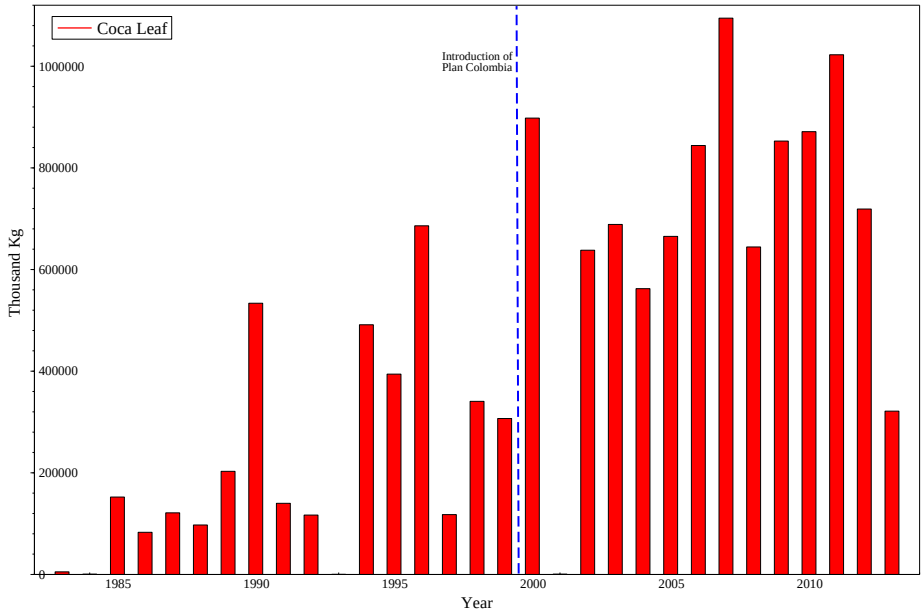
1. Introduction

Plan Colombia is a joint effort of the Colombian and the U.S. government to neutralize, among other things, organized crime groups that control coca cultivation for illegal drug production and trafficking in Colombia. Nevertheless, the literature offers no consensus on the effectiveness of this joint strategy in successfully confronting these armed groups. On the one hand, official reports by the Colombian authorities highlight significant reduction in the number of kidnappings and terrorist attacks by 92% and 77% respectively as well as a 56% decrease in the homicide rate since the implementation of the Plan Colombia in 2000 up to 2012 (Moreano, 2014). One of the strategic objectives of Plan Colombia sought to reduce the cultivation, processing and distribution of narcotics by 50% by 2007. From Figure 1 it is evident that since 2001 the number of coca leaf seizures have increased and according to official figures the total cultivated hectares have sensibly decreased (UNODC, 2015). A number of authors have questioned the cost effectiveness of the plan and its excessive toll on the local population (Mejia et al., 2015). The Plan Colombia is responsible for the displacement of approximately 6 million people since the beginning of the program and 7 million since records began.

Additionally, the Plan Colombia has been associated with the proliferation of illegal armed groups and drug trafficking in neighboring countries, particularly on the Ecuadorian bordering provinces (FGE, 2014). Due to the Plan Colombia the intensification of the internal armed conflict intensified in the early years of the century. Consequently, Ecuador has become the host of the largest refugee population in Latin America with an estimated 160,000 individuals requesting asylum since 2000, of which 98% are Colombian citizens (UNHCR, 2013). These people were quickly blamed by the local population as crime-prone. As a result of these events, it has caused significant political and social upheaval and a widespread feeling of insecurity in the Ecuadorian bordering regions with Colombia. Despite the importance of understanding the multidimensional impact the Plan Colombia has had in Ecuador

Figure 1: Coca leaf seizures in Colombia from 1983 - 2013 (Thousands Kg)



bordering provinces, there is a very limited number of studies that make an effort to address these questions. In particular, we have not encountered in the literature any empirical work, which attempts to assess the impact of the Plan Colombia on the incidence of violent crimes in the bordering provinces of Ecuador with Colombia. This is the first work that aims to draw any causal inferences on the topic.

In order to evaluate the Plan Colombia's impact on violent crimes we use a difference in difference approach. Particularly, we are interested in the incidence of violent crimes in the bordering provinces of Ecuador with Colombia with respect to the all other provinces. We measure violent crimes as the homicide rate in each Ecuadorean province. We are aware that homicides is just one of the many conflict/violence-related variables but, unfortunately, other measurements were not available nor reliable. In summary, we determined that the Plan Colombia did not have any crime-increasing effect on the bordering provinces of Ecuador. The results are robust to various specifications, such as considering averages or growth murder rates, and different time periods. As a next step, we evaluate whether

crime increased as migration soared. Given the likely endogeneity of the migration variable (Bianchi et al., 2012), we are going to instrument it with a measure of the intensity of the plan Colombia. The major concern with using such instrument is that the plan Colombia violate the exclusion restriction because of the spillover effects in Ecuador, especially the bordering provinces. However, as we have already anticipated, we do not find evidence of increased homicide rates as a result of the implementation of the plan. The instrumental variables analysis reveals that the idea that migrants leads to higher violence is not supported, as found by the recent literature on the topic (Bianchi et al., 2012). On the contrary, our results indicate an overall reduction in the violent crime rate.

The paper is organized as follow: section 2 describe the Plan Colombia and Ecuador. Section 3 presents the data, the econometric strategy and the results of the difference in difference methodology. The following section assesses whether migration impacted on the level of violence. Section 5 concludes.

2. Plan Colombia and its Spillover Effects in Ecuador

In a period of four years (1995 to 1999) Colombia became the biggest producer of coca leaf in the world. The decline in coca leaf production in Peru and Bolivia together with the increasing involvement of insurgents such as Fuerzas Armadas Revolucionarias (FARC) and right-wing paramilitary groups the Autodefensas Unidas de Colombia (AUC) resulted in an increase in coca bush production by 125 % during this period. As a consequence, in September 1999 the governments of Colombia and the United States agreed to implement a joint strategy in order to counteract the strengthening of illegal arm forces and surge in violence and crime in the country. Thus, by November 1999 the Plan Colombia: Plan for Peace, Prosperity, and the Strengthening of the State (or Plan Colombia) was born. In principle, the Plan Colombia was linked to security, economic development and ultimately

to the peace process[1]. However, one of the main strategic objectives of Plan Colombia over the period between 2001-2007 sought to reduce the cultivation, processing and distribution of narcotics by 50%. In order to achieve this goal, the Plan Colombia included several campaigns to destroy the production and processing of cocaine that included aerial spraying, manual eradication and control of chemical precursors used in the production of cocaine, the detection and destruction of cocaine processing laboratories, and seizing of drug shipments en route to other countries (Mejia et al., 2015). According to these authors, aerial spraying has been the main anti-drug strategy with approximately 128 thousand hectares being sprayed per year. More precisely, approximately a third of total coca cultivation and half of overall aerial spraying in Colombia between 2000 and 2010 had taken place in the departments bordering Ecuador of Putumayo y Nariño. As a consequence, the implementation of the Plan Colombia inventively affected the internal stability and security of Colombia through the intensification of the conflict as well as spillover effects neighboring countries like Ecuador.

The Plan Colombia has been a source of stiff arguments and discrepancies in its effectiveness to achieve peace and combat drug trafficking in the region. The Plan Colombia has not been cheap and the U.S. alone allocated $8 billion for its implementation between 2000 and 2012 (Beittel, 2011). Even though during this period the strategy was able to reduce by 50% the area of coca leaf cultivation, it was not able to reduce amount of coca leaf production itself (Gerson and Perez, 2012; Mejia and Posada, 2008; Mejia and Restrepo, 2013; Moreno-Sanchez et al., 2003; Reyes, 2014)[2]. Moreover, Mejia et al. (2015) investigated the deterrent effects of the aerial spraying program and conclude that spraying one additional

[1]The comprehensive strategy was designed to address five areas of action: (1) development of productive processes; (2) protection and promotion of human capital and humanitarian assistance; (3) institutional development and strengthening of social capital; (4) construction of an infrastructure for peace; (5) and promotion of a sustainable environment.

[2]For example, Reyes (2014) showed that a 1% increase in eradication of coca lead to approximately a 1% increase in coca cultivation.

hectare reduces coca leaf cultivation by about 0.2 to 0.65 hectares. However, the same authors estimated that a reduction in the cultivation area through aerial spraying by of 1% (800 hectares) has a cost to the U.S. taxpayers of 9.24−30 million dollars per year, would only reduce the supply of cocaine in the U.S. by 0.004%, or the equivalent to 20kg. On the other hand, other authors label the Plan Colombia "an extremely effective strategy" weighted by its success to reduce in half the effective forces of the FARC, reduction in crime and violence (Beittel, 2011). Despite the evidence provided for both sides of the arguments, it is evident that the implementation of the Plan Colombia had a disparate toll on the civilian population with approximately 7 million displaced individuals since records began (See Table 1) [3]. In addition to the local repercussions from the implementation of the Plan Colombia, this strategy has also caused an uproar in the bordering countries, particularly in Ecuador.

The spillover effects from the Plan Colombia were quickly felt in southern neighboring Ecuador. As a consequence from intensification of the conflict derived from the implementation of the Plan Colombia, there has been a great pressure in the social, economic and governmental infrastructure of Ecuador's bordering provinces with Colombia. A great concern has been placed on the shift of illegal activities and violence into Ecuador's bordering provinces. In particular, there has been a shift in production and distribution of cocaine to Ecuador, increasing presence of illegal Colombian armed groups as well as economic and productive damages in the Ecuadorian bordering regions. In a recent report by Ecuador's Attorney General reveals the extent to which the production and distribution of cocaine has been diverted to Ecuador's national territory in particular to the provinces of Carchi, Esmeraldas and Sucumbios (FGE, 2014). For example, the document cites that in August

[3]On this topic, there are some interesting works that analyzed the causes and consequences of displacement in Colombia. Ibáñez and Vélez (2008) estimated that the welfare losses of displacement are about 37% of the net present value of rural lifetime aggregate consumption. Ibáñez and Moya (2010) studied the magnitude of the changes in consumption and labor income after forced migration. The authors found huge drops in consumption and labor income but also asset losses and harsh conditions in destination cities, and the breaking of risk-sharing mechanisms.

Table 1: Total of people internally displaced in Colombia as a consequence of the armed conflict (in thousands)

	People Displaced	People Received	People Declared Displaced
Before 1999	996.72	736.151	892.509
1999	229.924	193.313	48.427
2000	477.718	509.323	321.22
2001	576.85	581.047	425.455
2002	677.348	658.977	511.105
2003	397.115	388.841	264.798
2004	365.896	364.098	247.614
2005	414.427	414.39	303.528
2006	409.964	418.252	363.567
2007	439.225	449.589	444.915
2008	394.729	419.534	490.448
2009	223.928	248.399	404.414
2010	166.804	184.362	345.74
2011	204.097	218.831	413.903
2012	213.606	223.872	491.383
2013	211.92	224.778	673.537
2014	150.753	164.912	638.302
Total	6551.024	6398.669	7280.865

Source: Consultoría para los Derechos Humanos y el Desplazamiento (CODHES). Estadísticas Historicas de Desplazamiento.

2012 alone a joint police operation between Ecuadorian and Colombian policy forces dismantled seven cocaine laboratories in Esmeraldas, Ecuador. On the other hand, it has been documented that irregular armed groups, such as FARC, paramilitaries and criminal gangs have been increasing their presence in Ecuador. FGE (2014) cites a number of incursions by the Aguilas Negras and Los Urabeños[4] in the provinces of Esmeraldas and Carchi where they presumable are currently operating. The spread of such illegal groups has been possible thanks to the weak presence of the Ecuadorian government in such areas.

Moreover, Ecuador began to experience an influx of internally displaced individuals seeking refugee from the armed conflict. In the year 2000, Ecuador had registered 390 individuals recognized as refugees by the Ecuadorian government. Today, by all estimated, Ecuador hosts the largest refugee population in Latin America, with mately 55,000 refugees officially recognized by the Ecuadorian government as of September, 2013 of which 98% are Colombian citizens (ACNUR, 2015). Nevertheless, and despite the fact that up to August, 2012 there were 108 (0.19%) individuals with refugee status incarcerated out of approximately 55,000 total refugees, the perception among the public and governmental authorities has linked the influx of refugees with the apparent increase in violent crimes.

Additionally, the economic spillovers from implementing the Plan Colombia have also been felt in the bordering provinces of Ecuador. The losses incurred by the Ecuadorian government from the traffic of fuel to supply the armed forces and drug traffickers are in the millions and in occasions cause disruptions in the local markets. Moreover, the aerial spraying has been conducted using Glyphosate mixed with Cosmoflux, which is a substance whose health and environmental effects are still unknown. Ultimately the Ecuadorian government sued Colombia in the International Court of Justice (ICJ) in 2008 where it alleged that

[4]These are organized gangs that control fluvial routes in the border provinces between Ecuador and Colombia for cocaine transportation and distribution.

aerial spraying by Colombia of toxic herbicides at locations near, at and across its border with Ecuador. Nevertheless, the health and economic effects on farmers from aerial spraying has been well debated and documented by Ecuadorian farmers who claim substantial losses in crops and livestock (Camacho and Mejía, 2013). It is worth reminding that the bordering provinces presented the worst socio-economic conditions compared to the rest of the country well before the implementation of the Plan Colombia. More recently, the incidence of poverty by 2010 in Esmeraldas, Sucumbios and Carchi was of 50%, 52% and 40% respectively while the national level was estimated to be significantly below at approximately 23% (FGE, 2014).

Summarizing, the plan Colombia had various spillover effects into Ecuador. However, in this paper we specifically focus on two: (1) the increased level of insecurity as a result of the intensification of the conflict; (2) The growing number of asylum seekers and refugees, which are seen as crime prone in the bordering regions.

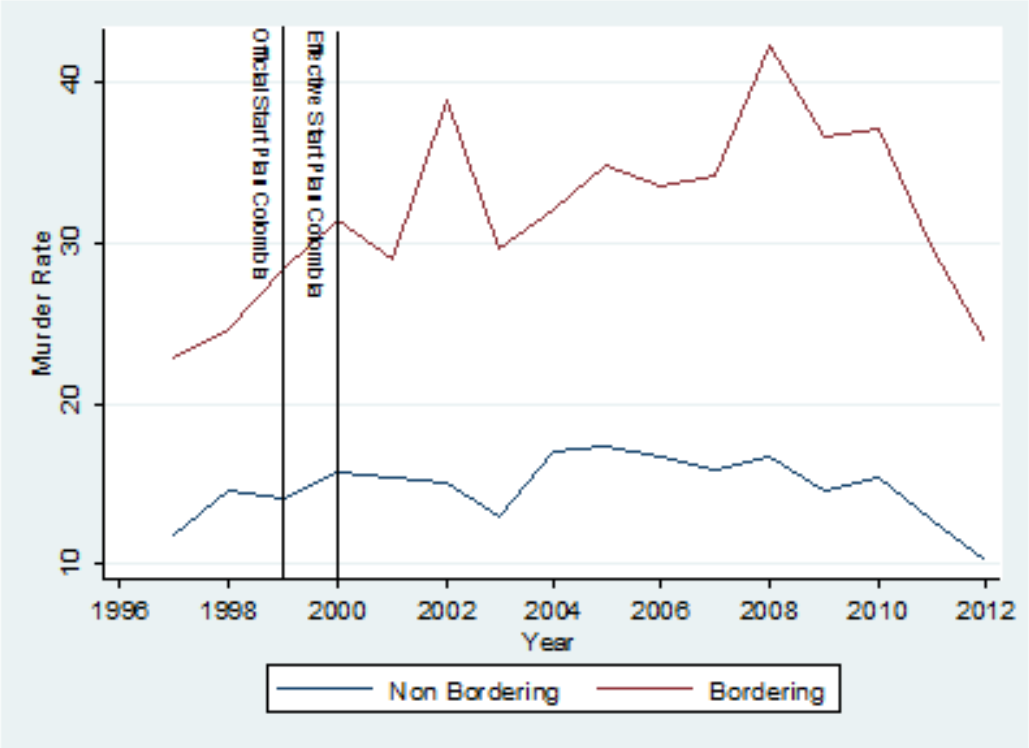
3. Data, Econometric Strategy and Results

We assess whether the bordering Ecuadorian provinces saw an increase in violence, measured by homicides, after the implementation of the plan Colombia. To do so, we employ a simple difference in difference approach. We compare the murder rates before and after the implementation of such programme between the "treated" bordering versus the "not treated" non bordering ones. We created an innovative panel data for Ecuador at the provincial level for the period 1997-2012. We considered 20 provinces, rather than the actual 24. This is because three provinces were created after 1998 and we decided to attribute their values to the original provinces in order to have comparable series. Moreover, we dropped Galapagos given its extreme distance from the mainland. Data on homicides have been taken from the annual statistics on "Deaths and Births" (Estadísticas de Nacimientos y Defunciones) published by the National Institute of Statistics and Censuses. The data set records the cause of death as registered in the death certificate as signed by the medical examiner. Due

to lack of data, we believe that this is the best measurement of violence we could get at the provincial level for such a long period. Again, it is worth reminding that homicides is just one of the proxies of violence. Unfortunately, we do not have any data on these other dimensions.

In Figure 2, we considered the homicide rates for the three bordering provinces versus the no bordering ones for all the years of the panel. We drew a line for the official start of the Plan Colombia , 1999, and also the effective implementation, 2000 [5]. As we can see, the rates are much higher for the provinces close to Colombia compared to the others, well before the official start of the Plan. After that, the same provinces do not exhibit a much different trend compared to the untreated ones. There is an apparent spike in the very first year after its implementation, 2000, but in the following years the two time series appear to be strongly correlated.

Figure 2: Homicide Rates in Bordering and Non-Bordering Provinces



[5] As we already said, the plan was signed by the end of 1999.

Formally, the difference in difference model we are testing is :

$$MurderRates_{i,t} = \beta_0 + \beta_1 Bord_i + \beta_2 PC_t + \beta_3 Bord_i \times PC_t + \beta_4 \cdot t + \varepsilon_{i,t}$$

where $MurderRates_{i,t}$ is the murder rate for the province i and year t; $Bord$ is a dummy equal to one for each of the three bordering provinces (i.e. Esmeraldas , Carchi and Sucumbios); PC_t captures the years in which the Plan Colombia was taking place and is equal to one from 2001 until time t, and zero before that; $Bord_i \times PC_t$ is an interaction term between the previous two variables, which captures the effect of the implementation of the Plan Colombia (measured as the murder rate) on the bordering province i. Consequently, the coefficient of interest from Equation (1) is β_3. By closely analyzing Figure 2, at first sight it suggests that there is very little or no effect at all. Finally, the terms $\beta_4 \cdot t$ is designed to capture the common inter-temporal shocks to all provinces.

In Table 2 we show the empirical results after estimating Equation (1). From Table 2 column I is model (1) as described in Equation (1). The coefficient $Bord_i$ is positive and very significant, which indicate that provinces at the border have higher murder rates compared to non bordering ones. The coefficient associated with the Plan Colombian, PC_t, is positive and significant. Similarly, the coefficient of interest, β_3 , is also positive but highly insignificant. This result let us to believe that the Plan Colombia did not increase the murder rates in the bordering provinces. In column II, we include the set of controls to Equation (1). The results for $Bord_i$ are very similar to the previous ones. However, now the coefficient PC_t is not statistically different from zero. We suspect that in column I the coefficient PC_t was capturing some other effects we did not control for and that are specific to each province. Thus, Table 2 column II includes a series of control variables, but again the coefficient of

interest β_3 is not significant. On the other hand, in Table 2 column III we decided to include an interaction term between the bordering provinces with each year after the Plan Colombia was implemented. By doing this our aim is to assess the impact of Plan Colombia in each year but, again, none of these interactions is significant.

Moreover, the (perceived) increased level of insecurity in the bordering provinces has led the Ecuadorian government to take actions to face the challenges arising from the spillovers from the internal conflict in Colombia. As a consequence, the government of president Rafael Correa decided to implement a strategy in order to counteract the detrimental social and economic effects from the conflict in efforts to increase the security among the bordering provinces. This strategy is the so-called "Plan Ecuador" and it consisted of three main pillars: (1) to consolidate the security, a culture of peace centered on the human being, satisfying their needs and enhancing their capabilities and freedoms; (2) maintain a policy of equitable and supportive international relations; (3) assert a defense policy based on protection of the population, natural resources, national heritage and effective control of the territory. In summary, the Plan Ecuador was designed in an effort to address the multidimensional and multi-sectoral impacts of the internal conflict of Colombia in the bordering regions of Ecuador. The Plan Ecuador had a number of plans to strengthen the economy of the the bordering provinces of Esmeraldas, Sucumbios and Carchi as well as Imbabura and Orellana given their proximity to the northern border. In addition, this policy also had aimed at increasing the number of military and police force in the bordering regions as a strategy[6] to increase the level of security along these provinces[7].Consequenty, the implementation of the plan Ecuador could create identification issues because these two policies

[6]This consisted in upgrading the presence of troops, air planes and helicopters in the most vulnerable areas. Moreover, other violent-reducing policies have been implemented, such as the prohibition to carry small weapons.

[7]We have dedicated a great level of effort in trying to obtain specific statistics on the distribution and number of military and policy forces for this policy. However, the ministry of defense categorically denied our request for data arguing that it was a matter of national security.

could work one against the other. To rule out such possibility, we considered only the period before the implementation of Plan Ecuador, i.e. 2008. The results of this exercise can be seen in Table 2 column IV. Again, we do not find any significant difference in the homicide rates between bordering and non bordering provinces after the implementation of the Plan Colombia. Interestingly, the coefficient PC_t, is now positive and strongly significant. Moreover, the "spillover" effects could extend not only to the three bordering provinces but also to Imbabura, which is also very close to the border with Colombia. In Table 2 column V, we estimate model (1) with 4 bordering provinces instead of three[8], but we are unable to determine any causal effect and the same conclusion remain. Continuing, we also consider five " treated" provinces , including also Napo[9], as bordering provinces. As before, β_3 is not significant.

In the crime literature, it is well known that homicide rates are very volatile. Therefore, in column VII we divide the whole panel , a total of 16 years, into five periods, one before and four after 2000, and calculated the average murder rate. In Table 3 column VII we considered three periods (1997-1999 and two after) and also calculated the murder rates. The results, in Table 3, show that for none of these specifications, the plan Colombia saw an increase in violence in the bordering provinces. We also considered year to year murder growth rates,in column VIII. As we already mentioned in Section 2, the plan Colombia formally started in 1999 but the policy actually took effect in 2000. Just to be on the safe side, we "postponed" the start date of the Plan to 2001. From Table 3 column X shows the results for this exercise. Again, none of the regressions has a significant impact on the homicides rates. Finally, we do not include the time dummies (Table 3 column XI) but the effect is still not significant.

[8]We include Imbabura as a possible bordering province given its proximity of two hours drive from the border to the largest city in the province (Ibarra).

[9]Which also includes Orellana.

Table 2: Impact of Plan Colombia on Homicides Rates in Ecuadorian Provinces (Part I)

	Basic I	Basic + Controls II	Interaction w/ Time III	Before 2008 IV	Four Provinces V	Five Provinces VI
Bord X PC	4.495	4.885		8.876		
	[4.866]	[5.519]		[7.216]		
Bord 4 X PC					3.215	
					[4.516]	
Bord 5 X PC						2.565
						[3.780]
Bord X 2000			3.278			
			[4.474]			
Bord X 2001			2.613			
			[5.999]			
Bord X 2002			12.645			
			[11.314]			
Bord X 2003			4.423			
			[5.660]			
Bord X 2004			2.429			
			[6.027]			
Bord X 2005			2.505			
			[5.867]			
Bord X 2006			3.087			
			[4.911]			
Bord X 2007			4.586			
			[6.949]			
Bord X 2008			9.982			
			[6.901]			
Bord X 2009			5.169			
			[6.077]			
Bord X 2010			5.357			
			[6.104]			
Bord X 2011			5.761			
			[4.700]			
Bord X 2012			1.746			
			[5.044]			
Bord	14.435**	12.201*	12.179*	8.573*		
	[4.994]	[5.365]	[5.465]	[3.569]		
Bord 4					8.587	
					[4.541]	
Bord 5						6.684
						[4.700]
Plan Colombia	-3.556*	0.293	0.587	12.412**	0.325	0.863
	[1.386]	[1.141]	[1.126]	[1.275]	[1.220]	[2.462]
Observations	320	320	320	260	320	320
R-squared	0.363	0.609	0.617	0.615	0.532	0.476
Controls	No	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Notes: ***: Significant at the 1% level; **: Significant at the 5% level; *: Significant at the 10% level. This table reports the the difference in difference results that evaluate the impact of the Plan Colombia on the level of homicide rates on Ecuadorian provinces. Data are from 1997 until 2012. The dependent variable is the provincial homicide rates. *Bord* is a dummy equal one if the province is either Sucumbios, Carchi or Esmeraldas. *Plan Colombia* or *PC* is a dummy equal to one from 2000 onward and 0 before. All the regressions, but column I, include the following controls: the percentage of young people, male and the interaction between these two on total provincial population; the density of population ; a proxy of the GDP, as explained in the text.

4. Impact of Colombian Migration on Crime Rates in Ecuador

To evaluate the impact of migration on homicide rates in Ecuador we consider a shorter version of the panel employed in the difference in difference specification. As main regressors we consider the total stock of asylum seekers, and refugees, weighted by provincial population. The difference between the two is that asylum seekers consider all applicants to asylum

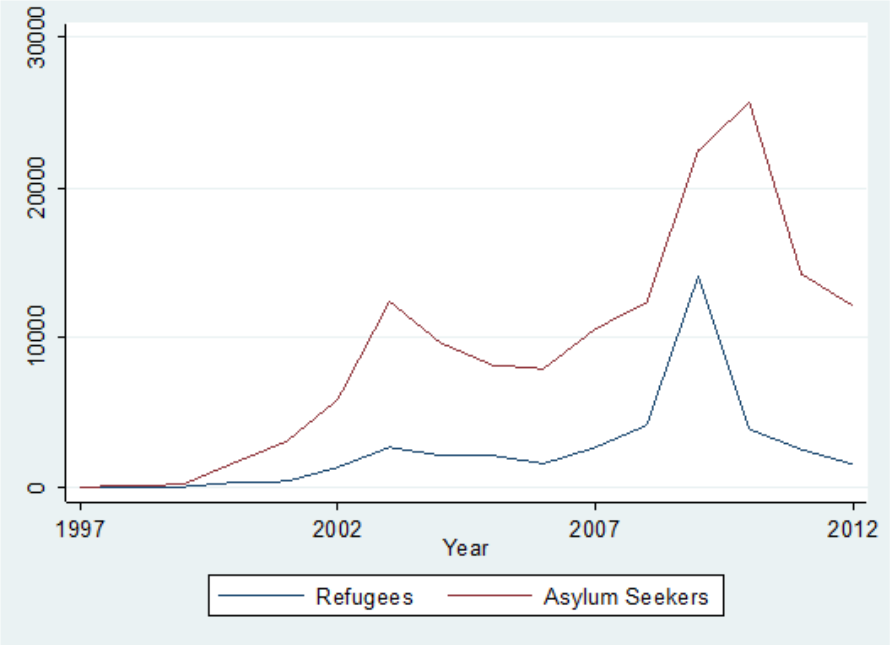
Table 3: Impact of Plan Colombia on Homicides Rates in Ecuadorian Provinces (Part II)

	Five Periods Average	Three Periods Average	One Yr Growth	Plan 2001	No Time Dummies
	VII	VIII	IX	X	XI
Bord X PC	7.207	6.507	12.823		4.9
	[6.664]	[5.851]	[22.243]		[5.414]
Bord	9.410*	9.388**	-40.656	13.011*	12.058*
	[3.897]	[3.091]	[42.882]	[6.038]	[5.103]
Plan Colombia	4.507**	4.259**	9.154		2.881**
	[0.906]	[0.557]	[36.966]		[0.740]
Plan Colombia 2001				0.346	
				[1.782]	
Observations	100	60	300	320	320
R-squared	0.655	0.679	0.196	0.609	0.596
Controls	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes

Notes: ***: Significant at the 1% level; **: Significant at the 5% level; *: Significant at the 10% level. This table reports the the difference in difference results that evaluate the impact of the Plan Colombia on the level of homicide rates on Ecuadorian provinces. Data are from 1997 until 2012. The dependent variable is the provincial homicide rates. *Bord* is a dummy equal one if the province is either Sucumbios, Carchi or Esmeraldas. *Plan Colombia* or *PC* is a dummy equal to one from 2000 onward and 0 before (except column X). In column VII, we collapsed the 16 year time span into five periods and calculated the average murder rates. In column VIII, we considered the average for three periods: one before the plan Colombia (1997-1999) and two after. In column IX we calculate year to year annual growth. Column X reports the same results as II, but the staring period of Plan Colombia is now 2001, rather 2000. The last column is the standard specification without time dummies. All the regressions include the following controls: the percentage of young people, male and the interaction between these two on total provincial population; the density of population ; a proxy of the GDP, as explained in the text.

whereas refugees are only the successful ones. We have data on the country of origins of these people, but only at a national, rather than at the provincial level. This data are taken from the Ecuadorian Ministry of Foreign Affairs (2013) which has kindly provided them to us. As we can see in the Figure 3 below, there were very few migrants until the year 2001 and then this number suddenly increased and kept rising until 2009. The big majority of them were Colombians, as already documented in section 2.

Figure 3: Number of Asylum Seekers and Refugees in Ecuador for the period 1997-2012



Our analysis fits into a growing literature that studies the impact of migration on crime, although mainly based on developed countries. Among them, the most relevant ones are: Bianchi et al. (2012); Bell and Machin (2013), Bell et al. (2013). The first investigated the impact of immigration on crime across Italian provinces during the period 1990-2003. They used an instrumental variable approach and found no effect of migration on any type of crime, except on robberies. Bell et al. (2013) analyzed the relationship between crime and migration for the UK from 1971 until 2001 at the neighborhood level. The authors employed an index score for crime along with various measures of crime taken from the British Crime Survey (BCS). They found a negative effect of migration on crime with the crime scores,

whereas the results with the BCS showed no relationship between migration and violent crime. Bell et al. (2013), the closest to ours, considered the impact of two migration waves on crime rates for the UK in the 2000s. The first wave was composed by asylum seekers and the second one started in 2004, when eight new countries joined the European Union. Neither waves had an impact on violent crime. However, asylum seekers had a positive and significant effect on property crime and the European wave had a negative and significant effect on property ones.

A geographical inspection of our data show that migrants were initially concentrated in the bordering province of Sucumbios[10]. Over the years, the wave of refugees has progressively spread across all three bordering provinces (Esmeraldas, Carchi and Sucumbios), as well as to other provinces relatively close to the border such as Imbabura and Pichincha, the latter corresponds to the the province where Quito, the capital of Ecuador is located[11]. Therefore, the "treated" regions extend the three bordering ones we considered earlier. Moreover, with such data we can assess the intensity of the spillover effects. There are still reasons to suspect that our explanatory migration variable is endogenous. This happens because of the presence of unobserved time-varying variables which can both affect migration decision and crime levels. Furthermore, Bell et al. (2013) suggested that, if immigrants decide to move to areas which are experiencing a decline in crime, this would also bias downward the coefficient. We solve the endogeneity by instrumenting migration in a similar fashion as Angrist and Kugler (2003) that considered migration from former Yugoslavia. This instrument is given by a national time series part and a cross sectional one. The former is the intensity of Plan Colombia because a progressive implementation of the plan lead to more conflict in the "coca" areas and more displaced people that went South. The cross sectional part is made of the inverse of the average distance from the three borders. Formally, we have:

[10]Map not shown but available on request.

[11]Both Imbabura and Pichincha are within two and four hours driving from the closest border with Colombia.

$$Instrument_{i,t} = \frac{1}{AvgDistance_i} \times \text{Intensity of PC}_t \tag{1}$$

We used various measure which represents the intensity of the Plan Colombia. The first one is *Aereal Fumigation* which is the total number of hectares which have been fumigated in Colombia weighted by the total number of hectares cultivated with coca for all Colombia. *Manual Fumigation* represents the rate of hectares of coca plants manually eradicated over the total number of hectares cultivated with coca. We also consider the total number of hectares manually eradicated plus fumigated weighted by the total number of hectares cultivated with coca for all Colombia, *Aerial and Manual*. *Coca Seizure* represents the total kilograms of coca seized divided by the total number of hectares cultivated with coca for all Colombia. *Laboratories* represents the number of coca laboratories destroyed. Finally, *All* is an over-identified model that includes *Aerial and Manual*, *Coca Seizure* and *Laboratories*. We multiplied the intensity of the Plan Colombia by the inverse of the average distance to the three t boarders, one for each province, in km. Provinces which are closer to the Colombian borders are likely to attract more immigrants. The inverse measure ensures us to have a potential positive relation. Therefore, we have the following structural and first stage equations:

$$MurderRate_{it} = \alpha_{it} + \gamma \widehat{Migration}_{it} + \gamma X_{it} + \zeta_i + \theta_t + \varepsilon_{it} \tag{2}$$

$$\widehat{Migration}_{it} = \alpha_{it} + \rho Instrument_{it} + \gamma X_{it} + \zeta_i + \theta_t + \varepsilon_{it} \tag{3}$$

The results of this instrumental variable exercise can be seen in Table 4. The coefficient of the first stage are always positive and highly significant. Indeed, migrants are more likely to arrive when the intensity of the Plan Colombia, i.e. intensity of conflict, is high and the province is close to the border. Moreover, the R-squared is quite high, well above 0.5 for all the specifications. The F-statistic are higher than the rule of thumb value of 10. The second stage results show that the coefficient is always negative and significant. An

increase in migrants in a province is associated with a decrease in the homicide rates. We find that these findings are robust to the use of different instruments and for just identified and over-identified model (last column). These results are similar to the ones found by the previous literature. When we use an over identified model, we are also able to check the validity of the instruments. The test show that we cannot reject the null hypothesis that all the instruments are valid. We conclude that the over identifying restriction is correct.

5. Conclusions

Plan Colombia is a multilateral strategy between the US and Colombia to fight, among other things, illegal drugs in Colombia. Such plan also produced spillover effects on neighbor countries, especially Ecuador. For example, it has shifted coca cultivation in the northern Ecuadorian provinces, along with the presence of guerilla members. In general, it increased the perception of insecurity in the three bordering provinces of Esmeraldas, Carchi and Sucumbios. Despite this policy relevance, there are not quantitative studies that analyzed whether, and to which extent, the implementation of the plan impacted on the level of violence in such bordering provinces. We fill such gap by using a newly created panel data at the provincial level for the period 1997-2012. As a dependent variable we use provincial homicide rates, the only available conflict-related variable. Indeed, we are aware that this is just one of the possible dimensions of violence. As estimation technique, we employed a simple difference in difference approach. Surprisingly, the results do not show a statistically significant increase in the homicide rates in such provinces compared to non-bordering provinces. This result is robust to different specifications such as averaging homicide rates for various time periods and calculating growth rates. Moreover, we recognize that the application of the so-called Plan Ecuador might invalidate the results. Therefore, we consider only the period before 2008. Again, we do not find any statistically significant effect of such plan on the level of violence.

As a next step, we evaluate whether Colombian migration in Ecuador, another consequences of the Plan Colombia in Ecuador, on the level of violence in Ecuadorian provinces. Given the likley endogeneity of the migration variable, we employ an instrumental variable approach. As an instrument we multiply the inverse of the average distance from the three borders by various measures of the intensity of the Plan Colombia. These include areal and manual fumigation, total quantity of coca seized and destroyed coca laboratories . The idea of using such unstrument is that, as the plan intensified, more and more people migrated south to escape violence in Colombia, especially to neighboring provinces. First stage results show a strong relevance condition. Most importantly, we are confident that the exclusion restriction applies in such case because we already found that the Plan Colombia did not increase violence in the bordering provinces. Our results highlight that migration, if anything, lead to a small reduction of homicide rates, even though the effect is very small. The results are robust across all the specifications.

We conclude that probably the perception of the crime/violence-related consequences of the Plan Colombia on Ecuador are considerably exaggerated. However, this judgment depends heavily on the lack of available data, which do not allow us to assess whether other forms of conflict significantly increased in the bordering provinces compared to non bordering provinces. Future research should be aimed at considering such other measures and also use geo-referenced data that would allow a more precise spatial analysis of spillovers.

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7. Appendix

Table 4: 2SLS estimation of the impact of *Migration* on Homicides Rates in Ecuadorian Provinces

Second Stage	**Murder Rate**	**Murder Rate**	**Murder Rate**	**Murder Rate**	**Murder Rate**	**Murder Rate**
Asylum_Seekers	-1.135*	-1.132***	-1.134**	-0.778*	-0.736**	-0.642*
	[0.630]	[0.412]	[0.444]	[0.397]	[0.333]	[0.354]
First Stage	Aereal Fumigation	Manual Eradication	Aereal and Manual	Coca Seizure	Laboratories	All
Instrument 1	5.845***	10.163***	5.084***	1.010***	176.620***	-2.727***
	[1.132]	[2.603]	[1.160]	[0.206]	[36.528]	[0.938]
Instrument 2						0.583***
						[0.096]
Instrument 3						151.054***
						[36.072]
Observations	260	260	260	260	260	260
R-squared	0.51	0.583	0.579	0.686	0.681	0.712
F test of excluded instruments	15.18	23.04	26.11	54.87	59.15	25.62
Overidentification Test (p-value)						0.1655
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: ***: Significant at the 1% level; **: Significant at the 5% level; *: Significant at the 10% level. This table reports the 2SLS and first stage results of the regressions which analyze the impact of asylum seekers on homicide rates for the 20 Ecuadorian provinces. All the regressions include the following controls: the percentage of young people, male and the interaction between these two on total provincial population; the density of population ; a proxy of the GDP, as explained in the text; the number of prisoners per 1,000 inhabitants. All instruments are calculated by multiplying the inverse of the average distance from the three borders by a measure of the intensity of Plan Colombia. *Aerial Fumigation* represents the ratio of the total number of hectares fumigated divided the total number of hectares cultivated with coca leaves multiplied by 100. *Manual Fumigation* represents the ratio of the total number of hectares of coca manually eradicated divided the total number of hectares cultivated with coca leaves multiplied by 100. *Aerial and Manual* represents the ratio of the total number of hectares fumigated plus the total number of hectares of coca manually eradicated divided the total number of hectares cultivated with coca leaves multiplied by 100. *Coca Seizure* is the sum of kilograms of cocaine hydrochloride, coca leaves and coca paste seized by the authorities divided the total number of hectares cultivated with coca leaves multiplied by 100 *Laboratories* is the total number of coca laboratories dismantled by the authorities divided the total number of hectares cultivated with coca leaves multiplied by 100. *All* includes *Aereal and Manual* (Instrument 1), *Coca Seizure* (Instrument 2) and *Laboratories* (Instrument 3).

Table 5: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Homicide Rates	320	13.04992	11.20388	0	67.25546
Car	320	549.6294	495.9582	0.968683	2488.736
Density of Population	320	67.95146	56.04677	1.942378	245.7997
Male Population	320	50.2957	2.110669	45.49681	56.05391
Young Population	320	27.0948	1.897081	12.61917	31.90259
*Male*Young Population*	320	1364.133	128.0209	622.3034	1722.189